ANALYSIS OF THE ENERGY ABSORBING PROPERTIES OF COMPOSITE MATERIALS USED IN TRANSPORT

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One of the most important properties of composite materials used in structural elements of automotive and wagon building, is the ability to dissipate energy impact in a collision, while lowering risk of injury to passengers.

Metal structural and traditional plating does not provide the ability of performing this task. Composite materials capable of absorbing large amounts of energy during impact and minimally deformed, while, in the amount of force it is constant during their destruction or has small fluctuation s. In structural materials there is no elastic deformation phase, like metals and main processes determining the absence of elastic deformation are cracking, fiber tear, destruction of matrix detachment from the matrix of reinforcing fibers and bundles. Thus, the macro- and microstructure of the composite material promote absorption of impact energy.

To keep the high-speed, high-energy impact of varying intensity composite materials formed by polymerizing resins and reinforcing laminate of woven fabrics with are frequently used particular fibers in the form of fiberglass and carbon fabric (carbon-fiber, carbon-Kevlar, Kevlar).

The analysis of investigations performed by different authors and the results of tests of composite materials made by polymerizing resin and a reinforcement of fiberglass and carbon fabric showed that the greatest strength and impact resistance has a composite based on carbon fabric. The specific energy absorption does not depend on the speed of impact and the mass of the object. The process of destruction of composites, FRP has a wavy character due to large deformation zones, energy absorption occurs with a large amplitude. When you break the fiberglass fiber energy absorption is minimal. More stable rates of destruction show composite materials made from carbon fabric. The amplitude of the energy absorption is less pronounced than in the destruction of composites, glass reinforced plastic (Figure 1).

The tests at shock loads showed that the carbon fabric reinforcement provides the best results in specific absorption of energy (60÷62 J/g), whereas the specific energy absorption of fiberglass reinforcing materials is in the range of 18÷34 J/g..

Holding high-speed impact of various carbon-fiber weave fibers provided a comprehensive mechanism of inhibition of growth of cracks:

1) creation of barriers to crack; involving complex interactions in the redistribution of stresses between the fibers and structural elements of the interface area; branching cracks predominantly in the axial direction.

2) blunting the crack tip due to the multistage relaxation processes;

3) low sensitivity to stress concentrators fibers.

Energy exchange between the two fracture systems arises from the fact that the cleavage and slip limiting structural fiber elements with respect to each other, the fiber acts as a part of the matrix up to the point of discontinuity fragment.

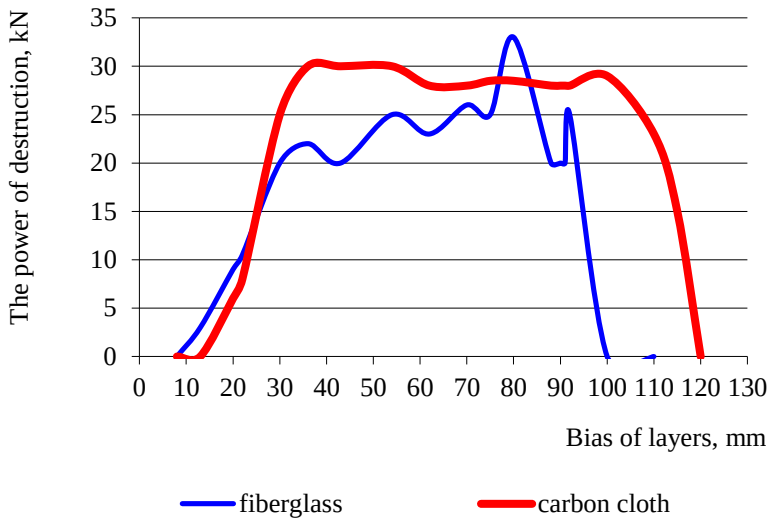

Fig. 1. The nature of the destruction of composite materials reinforced with fiberglass and carbon fabric.

Thus, macro- and microstructure of the composite material helps absorb impact energy.

Materials reinforced with carbon plastics can be used for indoor decoration of cars, covering of car seats and salons as a material that provides high specific strength and the best performance of passive safety.

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